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PATENT APPLICATION

ATTORNEY DOCKET NO. 10991744-4

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Janice Nickel

Confirmation No.: 8131

Application No.: 09/981,277

Examiner: K. Pierre

Filing Date: 10/17/2001

Group Art Unit: 2822

Title: METHOD OF FABRICATING AN MRAM DEVICE INCLUDING SPIN DEPENDENT TUNNELING JUNCTION MEMORY CELLS

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

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TRANSMITTAL LETTER FOR RESPONSE/AMENDMENT

Sir:

Transmitted herewith is/are the following in the above-identified application:

(X) Response/Amendment
( ) New fee as calculated below
(X) No additional fee (Address envelope to "Box Non-Fee Amendments")
(X) Other: Form PTO-1449 and one patent; and Rule 131 Decl. (fee $_____)
( ) Petition to extend time to respond
( ) Supplemental Declaration

CLAIMS AS AMENDED BY OTHER THAN A SMALL ENTITY						
(1) FOR	(2) CLAIMS REMAINING AFTER AMENDMENT	(3) NUMBER EXTRA	(4) HIGHEST NUMBER PREVIOUSLY PAID FOR	(5) PRESENT EXTRA	(6) RATE	(7) ADDITIONAL FEES
TOTAL CLAIMS		MINUS		= 0	X $18	$ 0
INDEP. CLAIMS		MINUS		= 0	X $84	$ 0
[ ] FIRST PRESENTATION OF A MULTIPLE DEPENDENT CLAIM					+ $280	$ 0
EXTENSION FEE	1ST MONTH $110.00 [ ]	2ND MONTH $400.00 [ ]	3RD MONTH $920.00 [ ]	4TH MONTH $1440.00 [ ]		$ 0
					OTHER FEES	$
					TOTAL ADDITIONAL FEE FOR THIS AMENDMENT	$ 0

Charge $ 0 to Deposit Account 08-2025. At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16, 1.17, 1.19, 1.20 and 1.21. ~~A duplicate copy of this sheet is enclosed.~~

I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office on the date shown below.

Date of Facsimile: 10/9/2002

Typed Name: Hugh P. Gortler

Signature:

Respectfully submitted,

Janice Nickel

By

Hugh P. Gortler

Attorney/Agent for Applicant(s)
Reg. No. 33,890

Date: 10/9/2002

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Rev 10/01 (TnAmdFax)

- Attach as First Page to Transmitted Papers -

#6 Reply 10/10/02

PATENT
PDNO 10991744-4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Janice Nickel	: Confirmation No. 8131
Serial No. 09/981,277	: Examiner Kenelt Pierre
Filed: October 17, 2001	: Group Art Unit: 2822

For: METHOD OF FABRICATING AN MRAM DEVICE INCLUDING SPIN DEPENDENT TUNNELING JUNCTION MEMORY CELLS

Box AF
Assistant Commissioner for Patents
Washington, D.C. 20231

RESPONSE TO OFFICE ACTION DATED JULY 18, 2002

Claims 12-20 are pending in this application.

Claims 12-20 are rejected.

In the office action dated 18 July 2002 and made final, claims 12, 15 and 16 remain rejected under 35 USC §102(b) as being anticipated by Gallagher et al., and claims 13, 14, and 17-20 remain rejected under 35 USC §103(a) as being unpatentable over Gallagher et al. in view of Inomata et al. These rejections are respectfully traversed.

Arguments in the previous response are restated. Claim 12 recites an SDT junction of a memory cell for an MRAM device. The junction comprises a bottom ferromagnetic layer, an insulating tunnel barrier atop the bottom ferromagnetic layer, and a top ferromagnetic layer atop the insulating tunnel barrier. The bottom ferromagnetic layer has flattened peaks.

Gallagher et al. also disclose an SDT junction. The structure of Gallagher

et al.'s magnetic tunnel junction 8 is described on col. 4, lines 16-25, and fabrication is described in col. 5, lines 49+. However, Gallagher et al. do not teach or suggest that the peaks of a bottom ferromagnetic layer are flattened.

Inomata et al. do not teach or suggest a bottom ferromagnetic layer having flattened peaks.

Because neither Gallagher et al. nor Inomata et al. teaches or suggests a bottom ferromagnetic layer having flattened peaks, claim 12 and its dependent claims 13-16 should be allowed over these patents.

Claim 17 recites SDT junctions including bottom ferromagnetic layers. Each bottom ferromagnetic layer has an upper surface, and each upper surface has a valley-to-peak height variation of no more than about one nanometer.

Neither Gallagher et al. nor Inomata et al. teaches or suggests such a valley-to-peak height variation. Therefore, claim 17 and its dependent claims 18-20 should be allowed over the combination of Gallagher et al. and Inomata et al.

In the latest office action, the examiner states that the arguments in the previous response fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes from the references. The undersigned is absolutely bewildered by this statement, since the previous response argued that neither Gallagher et al. nor Inomata et al. teaches or suggests a bottom ferromagnetic layer having flattened peaks, and that neither of these patents teaches or suggests a valley-to-peak height variation of about one nanometer.

After making this bewildering statement, the examiner then offers some "interesting" reasons as to why the claims are either anticipated or obvious. The examiner offers the following reasons as to why Gallagher suggests a bottom ferromagnetic layer having flattened peaks. He states

> With respect to claim 12, applicant argues, that Gallagher et al do not teach, "Surface smoothness (Flat peak) is very important to control resistance" and "a pinpoint cite of such teaching is not provided ". The Examiner would like to read the location of such teaching once more: The resistance of the MTJ 8 is strongly dependent on the thickness of the tunneling barrier layer 22, its electronic barrier height, and the layer material properties, such as the surface smoothness of the lower layers (Col.6, line 24 to 45). Therefore, the Examiner considers said surface smoothness to the parameter that indicates the nature of the surface. Mentioning "Surface smoothness" equivalent to mentioning "Surface roughness" which implies the presence or the absence of peaks on the surface. "Flattened peaks" means smooth surface, and "non-flattened peaks" mean rough surface.

Gallagher et al. do indeed state that resistance of the MJT 8 is dependent upon thickness of tunneling barrier layer 22 and the surface smoothness of the lower layers. However, they do not make the general suggestion of smoothing the bottom ferromagnetic layer or the specific suggestion of flattening peaks of the bottom ferromagnetic layer.

The examiner states that "flattened peaks" means smooth surface, and non-flattened peaks means rough surface. The applicant, who has significant industry experience and holds patents in MRAM design, is not aware of these definitions. Moreover, the examiner has not offered any documents supporting these definitions. Therefore, it is assumed that these definitions are based on the personal knowledge of the examiner. Pursuant to MPEP §707 and 37 CFR §1.104(d)(2), the examiner is respectfully requested to cite a document or make

an affidavit supporting his personal knowledge that flattened peaks means smooth surface, and non-flattened peaks means rough surface.

It is not likely that the examiner will find support for his definitions. Roughness or smoothness of a surface is a function of factors such as lattice mismatch, and strain between layers. Smoothing, in contrast, is an operation that is performed on the grains.

Finally, the examiner argues that Gallagher and Inomata et al. disclose a peak-to-valley height variation of about one nanometer. The previous office action stated that such a variation is disclosed in a passage on col. 19, lines 60-67 of Inomata et al. It is not. This passage merely states "grain size may preferably be 1 nm or more so as not to have super-paramagnetism. Grain size refers to the diameter of the grains, not their height.

The examiner states

> With respect to claim 17, Applicant argues, that neither Gallagher et al nor Inomata et al teach "Valley to peak variation". Applicant argues, " Grain size refers to the diameter of grains, not their height". The Examiner begs to differ by invoking a "Basic geometry laws " If the grain size refers to the diameter of the grain, this implies that the grain is a circle. The diameter of a circle is also the height and the width of the circle since a circle is by definition a closed line smooth with no sharp angle. Therefore, a layer formed by these grains will have at its interface valley to peak variation equal to the grain size unless the grain interface surface is rendered smoother by polishing.

This statement suggests that a grain is spherical.

The applicant, who has significant industry experience and holds patents in

MRAM design, is not aware of these "Basic geometry laws" as applied to grains of a ferromagnetic layer. The examiner has not cited a document that sets forth these" Basic geometry laws" for grains, so it is presumed that he is once again relying on personal knowledge. Pursuant to MPEP §707 and 37 CFR §1.104(d)(2), the examiner is respectfully requested to cite a document or affidavit supporting his personal knowledge that the diameter of a grain is its height and the width; and that "a layer formed by these grains will have at its interface valley to peak variation equal to the grain size unless the grain interface surface is rendered smoother by polishing."

It is unlikely that the examiner will find such a document. It is well known that the grains of a ferromagnetic layer are not spherical as the examiner suggests. The grains exhibit columnar growth. The diameter of the grain does not determine its height or a peak-to-valley difference of the layer.

In conclusion, neither Gallagher et al. nor Inomata et al. teaches or suggests a bottom ferromagnetic layer having flattened peaks. The examiner does not cite any documents showing this difference between claim 12 and the combination of Gallagher et al. and Inomata et al. Instead, the examiner uses his flawed personal knowledge to make the '102 rejection. Clearly the examiner has not made a prima facie case of anticipation with respect to claims 12, 15 and 16. Therefore, the '102 rejections of claims 12, 15 and 16 should be withdrawn.

Finally, neither Gallagher et al. nor Inomata et al. teaches or suggests such a valley-to-peak height variation of about one nanometer. The examiner does not cite any documents showing such a valley-to-peak height variation. Instead, the examiner uses his flawed personal knowledge to make such a showing. Clearly the examiner has not made a prima facie case of obviousness with respect to claims 13, 14, and 17-20. Therefore, the '103 rejections of claims 13, 14, and 17-

20 should be withdrawn.

A form PTO-1449 and a copy of Chen et al. U.S. Patent No. 6,292,389 are attached. The '389 patent is hereby submitted under 37 CFR 1.97(c) with a statement under 37 CFR 1.97(e). The '389 patent was revealed in an office action on a divisional application. Although the office action was dated May 22, 2002, the undersigned did not become aware of the '389 patent until early August of 2002. It is respectfully requested that the '389 patent be made of record.

Also attached is a Rule 131 declaration. The Rule 131 declaration includes an invention disclosure that was prepared by the inventor. The invention disclosure is dated June 3, 1999 and was received by the Hewlett-Packard legal department on June 4, 1999. The invention disclosure establishes that the inventions of claims 12 and 17 were actually reduced to practice prior to June 3, 1999 before the filing date of the '389 patent.

The examiner is respectfully requested to withdraw the rejection of claims 12-20, make the Chen et al. patent of record, enter the Rule 131 declaration, and issue a notice of allowability. If issues remain, the examiner is invited to contact the undersigned to discuss those remaining issues.

Respectfully submitted,

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Date: October 9, 2002

I hereby certify that this correspondence is being facsimile transmitted to the United States Patent and Trademark Office on October 9, 2002.

Hugh P. Gortler